

Name: _____

Date: _____

s17 Geometric Series Exam (Solution v25)

Question 1

Consider the partial geometric series represented below with first term $a = 800$, common ratio $r = \left(\frac{23}{40}\right)^{1/10}$, and $n = 10$ terms.

$$S = 800 + 756.93 + 716.18 + 677.63 + 641.15 + 606.63 + 573.97 + 543.07 + 513.84 + 486.17$$

We can multiply both sides by r .

$$rS = 756.93 + 716.18 + 677.63 + 641.15 + 606.63 + 573.97 + 543.07 + 513.84 + 486.17 + 460$$

What is the value of $S - rS$?

Most terms cancel.

$$800 - 460 = 340$$

Question 2

Consider the geometric series shown below, using ellipsis notation to indicate a continuation of the pattern without writing every term.

$$S = 6 + 6(8) + 6(8)^2 + 6(8)^3 + \cdots + 6(8)^{48} + 6(8)^{49} + 6(8)^{50} + 6(8)^{51}$$

Identify the initial term, the common ratio, and the number of terms.

$$\text{first term} = a = 6$$

$$\text{common ratio} = r = 8$$

$$\text{number of terms} = n = 52$$

Question 3

Write a proof for the partial geometric series formula.

- Define the variables.
- Write the sum using variables and ellipsis notation. You can implicitly assume the number of terms is more than the number of terms you choose to write.
- Using annotated algebraic manipulation, produce the partial geometric series formula.

Definitions

a = first term

r = common ratio

n = number of terms

S = sum of partial geometric series

The partial geometric series is expressed using ellipsis notation.

$$S = a + ar + ar^2 + ar^3 + \cdots + ar^{n-4} + ar^{n-3} + ar^{n-2} + ar^{n-1}$$

Multiply both sides by r .

$$rS = ar + ar^2 + ar^3 + ar^4 + \cdots + ar^{n-3} + ar^{n-2} + ar^{n-1} + ar^n$$

Subtract the second equation from the first equation.

$$S - rS = a - ar^n$$

Factor out S from left side.

$$S(1 - r) = a - ar^n$$

Divide both sides by $(1 - r)$. We technically need to enforce $r \neq 1$ as a condition of the formula because otherwise we'd be dividing by 0 in this step, and division by 0 is not defined.

$$S = \frac{a - ar^n}{1 - r}$$